

MULTIMEDIA



UNIVERSITY

STUDENT ID NO

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MULTIMEDIA UNIVERSITY

FINAL EXAMINATION

TRIMESTER 1, 2017/2018

PCM0035 – GENERAL CHEMISTRY

(All sections / Groups)

12 OCTOBER 2017
9.00 a.m – 11.00 a.m
(2 Hours)

INSTRUCTIONS TO STUDENTS

1. This Question paper consists of 4 pages with 3 Questions only, excluding the cover page.
2. Attempt **ALL** questions. Distribution of the marks for each question is given.
3. Please write all your answers in the Answer Booklet provided.

QUESTION 1 [20 MARKS]

- (a) (i) State all possible angular momentum quantum numbers (l) and magnetic quantum numbers (m_l) for principal quantum number of $n = 4$. [2½ marks]
- (ii) An electron with the quantum numbers of $n = 3$, $l = 1$, $m_l = +1$, $m_s = +\frac{1}{2}$ is located in which orbital? [½ mark]
- (iii) How many electrons in an atom can have the quantum numbers of $n = 4$, $l = 2$? [½ mark]
- (b) Fill in all the blanks in the following Table 1.

Table 1

Name and Symbol	Property of Quantum Number
Angular Momentum, l	
	Average distance of the electron from the nucleus
Magnetic, m_l	

(Copy the table and provide the answers in the Answer Booklet) [1½ marks]

- (c) (i) Provide the ground-state electron configuration for chromium (atomic number = 24), without using a noble gas core. [1 mark]
- (ii) Sketch the orbital diagram for fluorine (atomic number = 9). [1 mark]
- (d) Generally, atomic radius increases or decreases down a group? Discuss your answer. [2 marks]
- (e) Write a balanced equation of the reaction of calcium oxide in water. Does this reaction produce an acidic or basic solution? [1 mark]
- (f) Given a compound: phosphorus tribromide (PBr_3).
- (i) Is PBr_3 an ionic compound or a covalent compound? Explain your answer. [1½ marks]
- (ii) Draw the *Lewis structure* for PBr_3 . [1½ marks]
- (iii) How many lone pair electron does PBr_3 has? [½ mark]
[atomic number for P = 15; atomic number for Br = 35]
- (iv) Name the shape (molecular geometry) and give the AB_mE_n classification for PBr_3 . [2 marks]

Continued...

- (g) There are three exceptions to the octet rule in chemical bonding. Name and describe only one of them with example.

[1½ marks]

- (h) For the following compound in Figure 1:

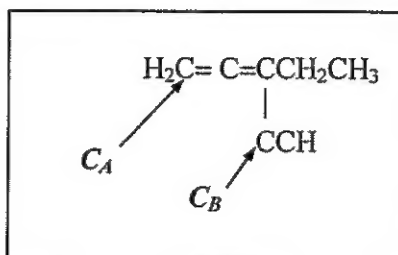


Figure 1

- (i) Predict the correct hybridization for the carbon atoms, C_A and C_B , indicated in the molecule shown above.

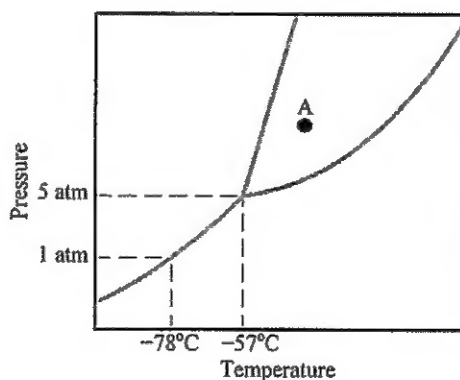
[2 marks]

- (ii) Determine the number of sigma (σ) bonds and pi (π) bonds in the molecule.

[1 mark]

QUESTION 2 [15 MARKS]

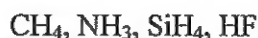
- (a) The phase diagram of carbon dioxide is given. Consider a sample of carbon dioxide at position A.



- (i) State the temperature and pressure of triple point for carbon dioxide. What is the significance of triple point? [1½ mark]
- (ii) Explain the changes when sample A is cooled at constant pressure to -78°C . [1 mark]
- (iii) Explain the changes when the pressure of sample A is reduced at constant temperature to 1 atm, then it is cooled at constant pressure to -85°C . [2 marks]

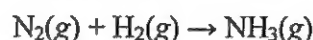
Continued...

- (b) Which of the following substances exhibits hydrogen bond? Explain your answer.



[2 marks]

- (c) Consider the production of ammonia from the reaction between hydrogen and nitrogen.



- (i) Write a balanced equation. [½ mark]

- (ii) What is the rate of ammonia production when hydrogen reacts with the rate of $-0.55 \text{ mol/L}\cdot\text{s}$. [2 marks]

- (d) Consider the following formation reaction. Table 2 shows the experimental data for this reaction.

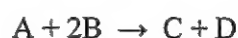


Table 2

Experiment	Initial Rate (mol/L·s)	Initial [A] (mol/L)	Initial [B] (mol/L)
1	0.016	2.5	1.5
2	0.016	2.5	3.0
3	0.032	5.0	1.5

- (i) Find the reaction order with respect to A and B. [3½ marks]

- (ii) Write the rate law for this reaction. [½ mark]

- (iii) Find the rate constant of the reaction. [1 mark]

- (iv) What is the half-life of the reaction? [1 mark]

QUESTION 3 [15 MARKS]

- (a) Calculate the H^+ and OH^- concentrations (in mol/L) for the solution with pH of 4.00. [3 marks]

- (b) Identify the *conjugate acid-base pairs* for the following equation:



[2 marks]

- (c) Based on their molecular structure, identify and explain which of the following pairs of acid is weaker:

- (i) HF and HBr [2 marks]

- (ii) HOClO_2 and HOClO [2 marks]

Continued...

- (d) Aluminum metal displaces zinc(II) ion from aqueous solution in a galvanic cell.
- (i) Write an oxidation and reduction half equations for this redox reaction. [1 mark]
 - (ii) Write a cell diagram for voltaic cell in which this reaction occurs. [1 mark]
 - (iii) Predict the direction of electron flow when the two electrodes (aluminum electrode and zinc electrode) are connected. [$\frac{1}{2}$ mark]
- (e) In a process, 10 minutes is needed to deposit 0.7 gram of solid nickel on a metal object using a current of 5A. The oxidation state for nickel is reduced from +2 to 0.
[Atomic mass: Ni = 58.69; Faraday constant: 96500 C/mol·e⁻]
- (i) Write a balance reduction half-reaction of Ni. [1 mark]
 - (ii) Calculate the amount of charge needed in the process. [1½ marks]
 - (iii) Calculate the amount of current used in the process. [1 mark]

End of Paper